

Societal Responses and Challenges

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Good morning. I'm John Gannon, currently in transition between the U.S. Geological Survey, Great Lakes Science Center, in Ann Arbor, Michigan, and the International Joint Commission, Great Lakes office in Windsor, Ontario. I am honored to present to you this morning some challenges and opportunities that we face as we consider our societal responses to the state of the Great Lakes ecosystem and the pressures that influence environmental conditions.

Pressures Impacting Major Issues

Major Issues

Major Pressures		Edible Fish	Drink	Swim	Breathe	Eco-system
	Non-native Species	X	X	X		X
	Contaminants & Pathogens	X	X	X	X	X
	Habitat Alteration	X				X

Let me briefly recap what you have just heard in the presentations by Jan Ciborowski and Donna Myers. Jan talked about some of the major issues (here in blue) and the status of environmental components related to those issues. You heard information related to the questions, “Can we eat the fish? Can we drink the water? Can we swim in the water? Is the air healthy to breath?” You also heard about several components of the Great Lakes ecosystem and some features that support the food web.

Societal Influences on Pressures

		Major Pressures		
Societal Influences		Non-native Species	Contaminants & Pathogens	Habitat Alteration
	Urban Density	X	X	X
	Solid Waste Generation		X	X
	Energy Consumption		X	X
	Water Use			X

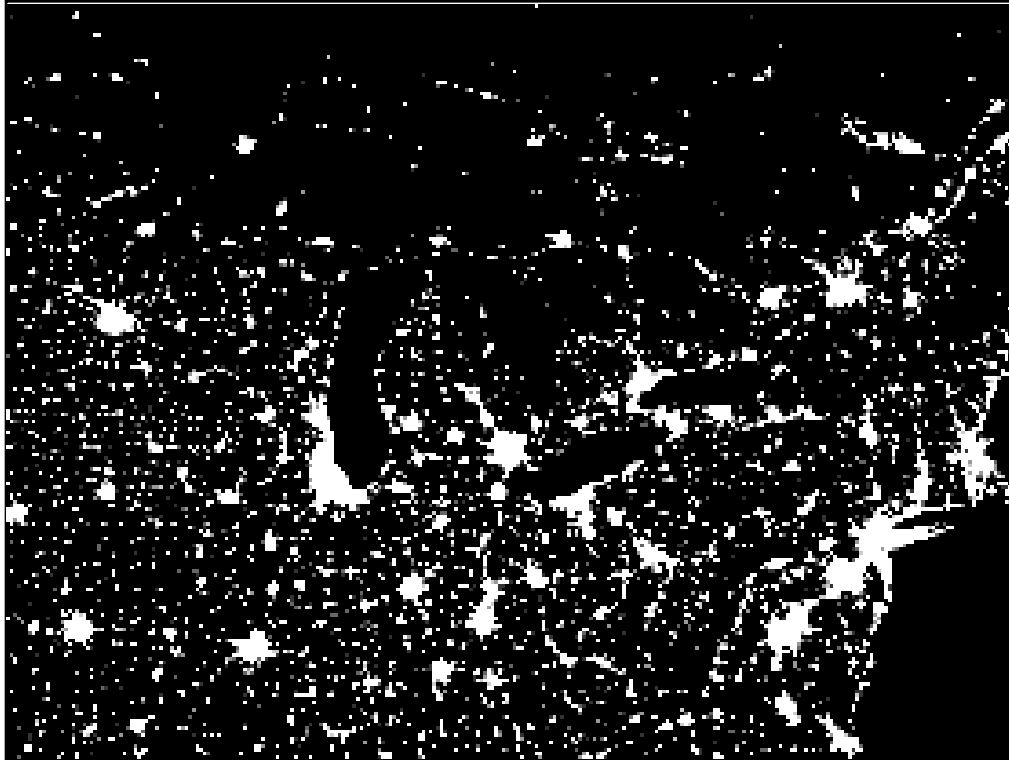
What I am going to present to you now are some of the aspects and activities of our human society that affect the pressures on the Great Lakes. Here I have displayed the major pressures, still in the green boxes, as column headings. In the orange boxes I have listed some of the aspects of our human society that influence, for good or bad, one or more of the major pressures. In a moment I will show you some results from indicator reports on these aspects, but for now, consider that all of these aspects have potential to alter habitat, and most of them could also elevate levels of contaminants and pathogens.

Light and heat signals detected by satellite sensors



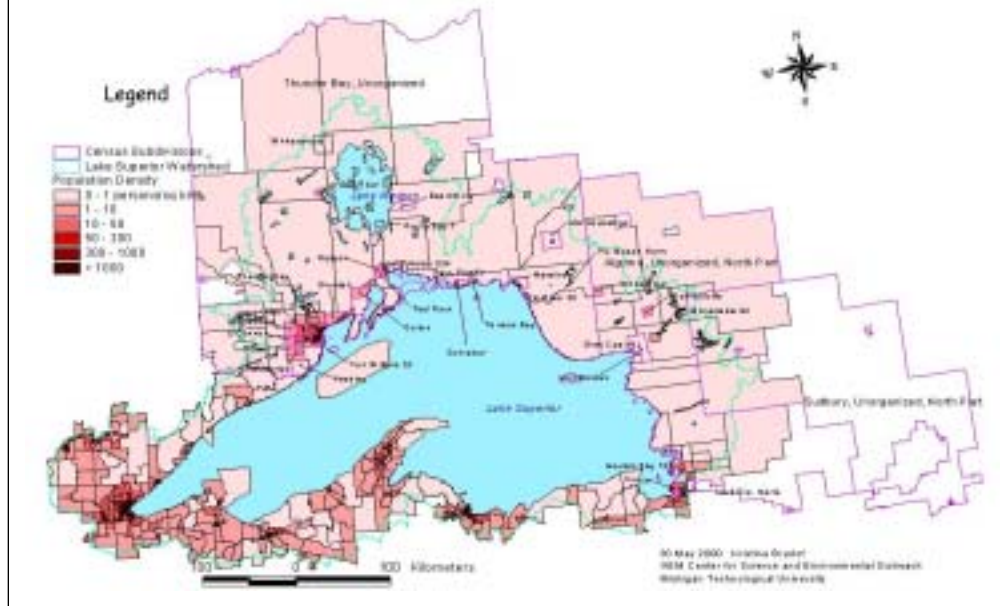
Let's begin with the indicator for Urban Density. The abundance of human habitation in the Great Lakes basin has much to do with the potential for introductions of toxic contaminants and for the nurturing of pathogens. It goes without saying that the urban landscape drastically changes the abundance of native habitat.

To illustrate the abundance of human population in the U.S. and southern Canada, and in the Great Lakes basin in particular, consider this composite satellite imagery of nighttime light and infra-red sources in the U.S.



There are very few places on the entire coast of the Great Lakes, from Duluth, Minnesota, to the Gulf of St. Lawrence that are not outlined by human habitation.

Population Density, Lake Superior Watershed, 1990 - 91

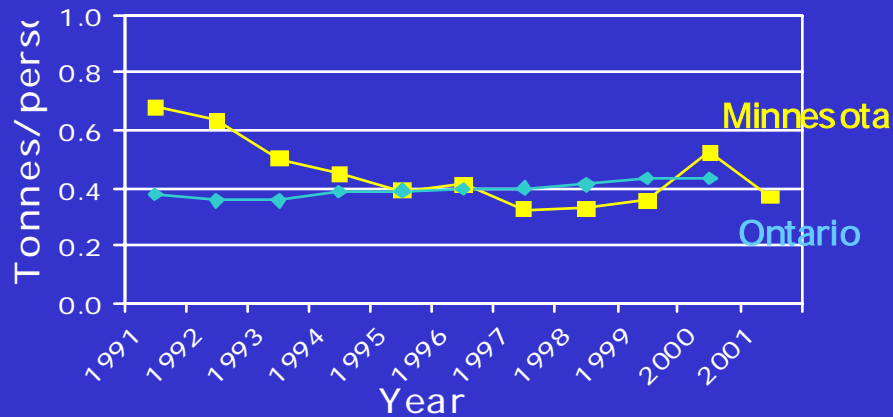


We can also track population densities around the Great Lakes, using census data. Illustrated here, for example, are population densities from the 1990-1991 census for Lake Superior. In this figure, very dark brown areas represent greater than 1000 people per square kilometer.

[Should mention that this was an example that we had at hand. Other Lakes will show similar patterns] ?

A closer inspection of the data illustrates a common feature of highly dense populations in urban areas, followed by diminishing population densities away from the urban centers. To track suburban sprawl in these areas would require using these data over decade time periods. The message, however, remains that the Great Lakes proper, and the surrounding watershed, are under very large pressures from human habitation.

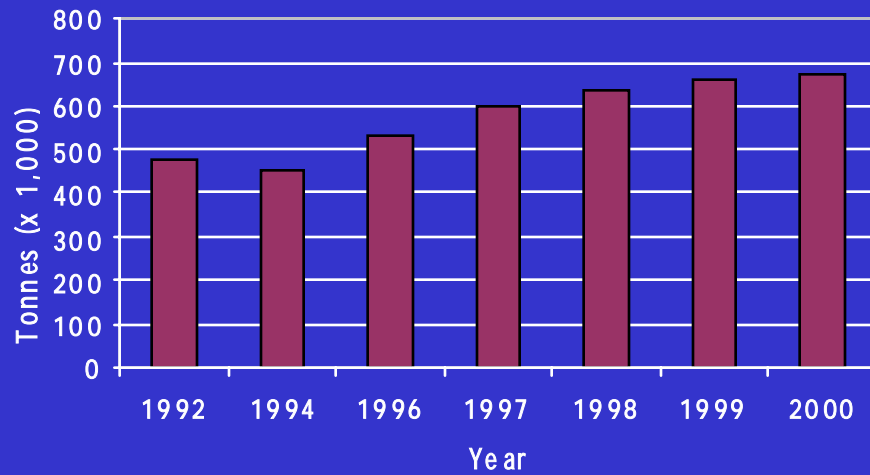
Average Per Capita Solid Waste Disposal in Ontario and Minnesota (Tonnes/person)



Another societal indicator that relates to contaminants, pathogens and healthy habitats is the quantity of solid waste generated in the Great Lakes basin.

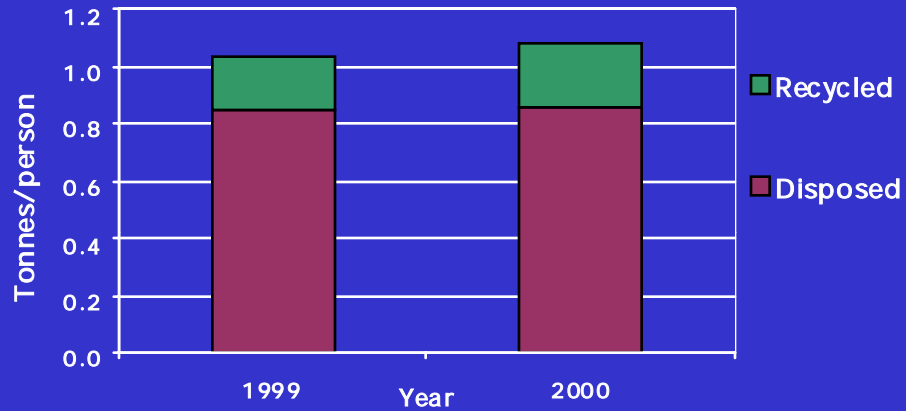
Statistics on the quantity of solid waste that is generated, disposed, and recycled are readily available from the Province of Ontario and the Great Lakes states. Unfortunately, each jurisdiction tracks and reports different aspects of solid waste handling. Minnesota and Ontario, seen here in yellow and light blue respectively, assess the quantity of municipal wastes that are disposed, not including that which is recycled. Since 1991, the per capita disposal of solid waste has declined in Ontario, and has remained steady in Minnesota counties in the Great Lakes basin.

Recycling Tonnages in Ontario (1992 - 2000)



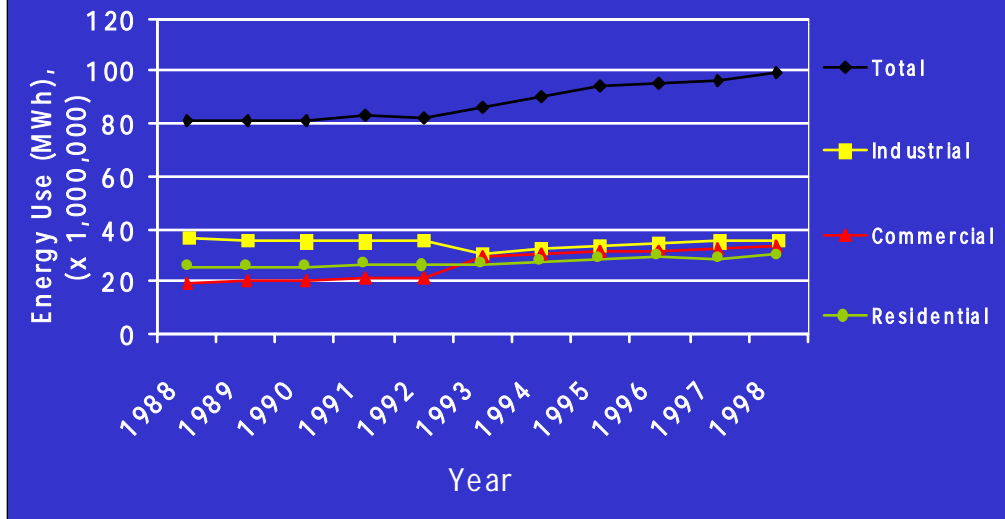
Looking now at some data on the quantity of wastes that were recycled, we see that since 1994 in Ontario, the gross tonnage of recycled materials has increased each year.

Average Per Capita Solid Waste Generated, Disposed, Recycled; Ohio, 1999 - 2000



Similarly, data for 1999 and 2000 for northern Ohio waste districts show a slight increase in the per capita quantity of recycled wastes in 2000 (the green bar). Approximately 20% of the total waste generated was recycled.

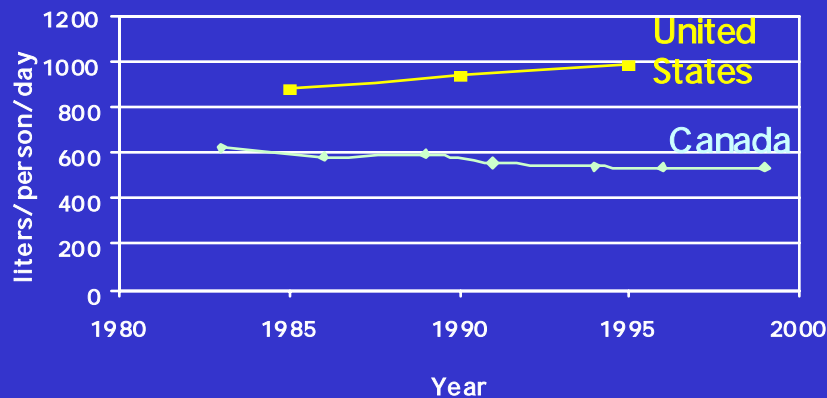
Electric Energy Consumption (MWh) in Michigan by Sector, 1988 - 1998



The quantity of electric energy used in the Great Lakes basin can impact the quantity of contaminants in the system and the quality and quantity of native habitats. The more electricity we use, the more power generation is needed. Notwithstanding a number of effective programs and technologies for cleaner generation of electricity, depending on the facility, power generation can contribute fossil fuel combustion byproducts or spent nuclear fuel to the environment. Hydro-power generation generally involves damming of rivers and streams, which of course greatly alters habitat.

Here we look at total electric energy used by sector within the state of Michigan for the period 1988 to 1998 as an example of electricity consumption in the Great Lakes basin. Since 1992, the three sectors (residential, commercial, and industrial) all consumed nearly equal quantities of electricity, with an increase of nearly 25% from 1992 to 1998.

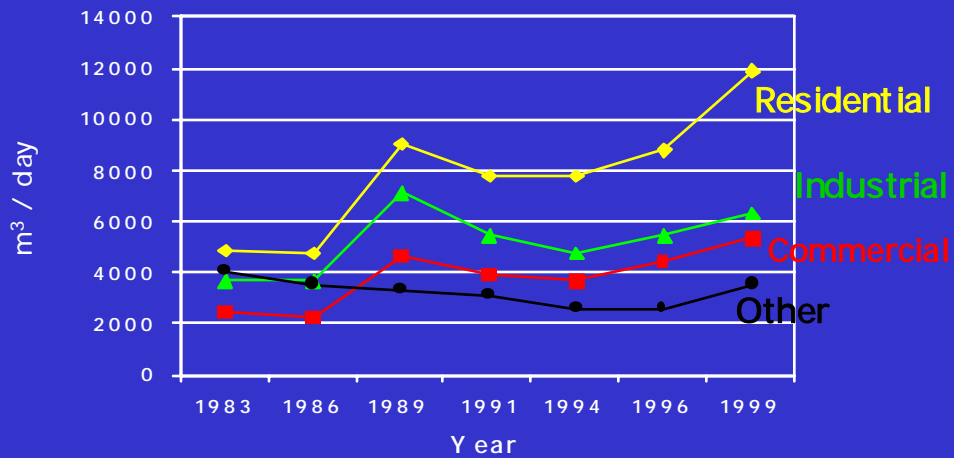
Average Daily Per Capita Municipal Water Use in Great Lakes Basin: Canada (1983-1999), U.S. (1985-1995)



This slide shows total municipal use of water by residents in the Great Lakes basin, but its direct impact on non-native species, contaminants or habitats seems limited. A different indicator looks at the quantity of contaminants in the wastewater stream entering the Great Lakes, but we have not yet compiled the data to report on that indicator.

In general, we would like to see a decrease in per capita water use as an indicator of improving conservation and sustainable living practices. Daily per capita use of water in the Great Lakes basin from 1983 to 1999 was greater for U.S. residents than for Canadian, and use in the U.S. increased during this time period, while Canadian per capita use declined.

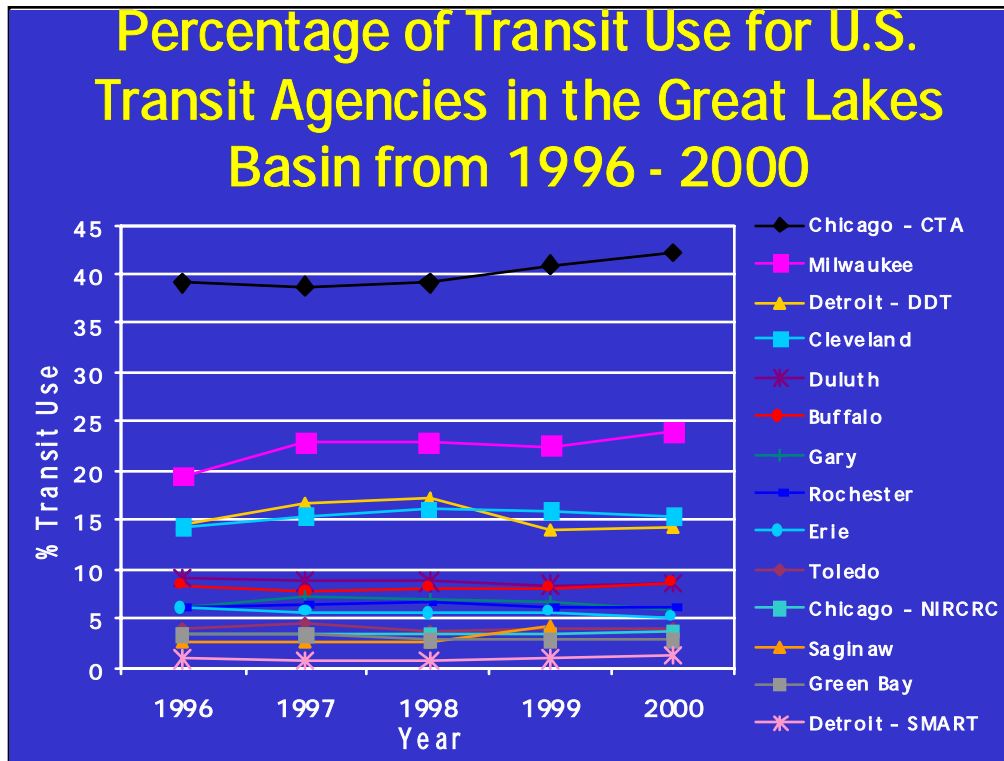
Daily Average Municipal Water Use By Sector in the Canadian Great Lakes Basin: (1983-1999)



Data were available for analyzing average daily municipal water use by sector from 1983 to 1999 on the Canadian side of the Great Lakes basin. Total residential water use was greater than that for either commercial or industrial users. Industrial users may make use of more water per facility, but there are so many more residential users that their cumulative water use is greater. Residential water use has also been increasing at a faster rate in recent years than has water used by the other sectors.

Influences on Pressures				
		Major Pressures		
Societal Responses		Non-native Species	Contaminants & Pathogens	Habitat Alteration
	Mass Transportation		X	X
	Brownfield Redevelopment		X	X
	Place-Based Stewardship	X	X	X
	Sustainable Agriculture	X	X	X

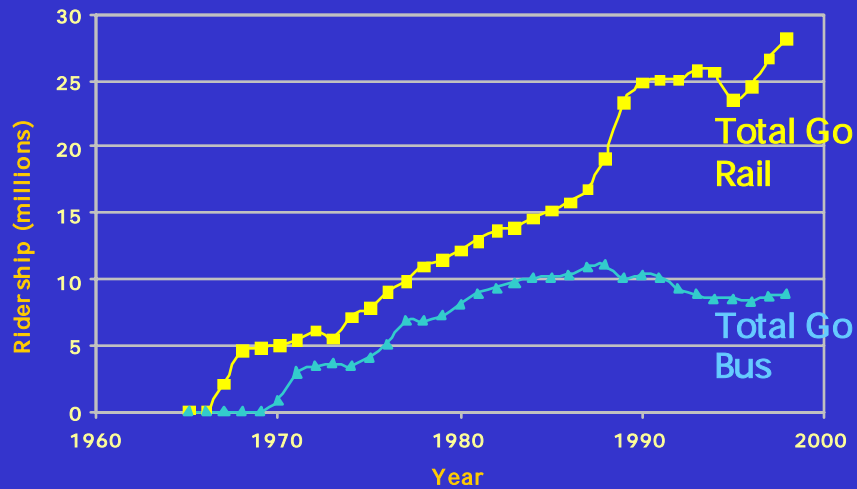
Now we will take a look at a few activities, or so-called societal responses, that have the potential to modify one or more aspects of the major pressures on the Great Lakes ecosystem. The indicators include Mass Transportation, Brownfields Redevelopment, Place-Based Stewardship Activities, and Sustainable Agricultural Practices. Of these, Place-based stewardship activities and sustainable agricultural practices appear to have potential for mitigating the spread of non-native species.



A measure of human response to reducing the impacts of urban areas on the Great Lakes ecosystem is the use of mass transportation. Increased per capita ridership on mass transit systems would lessen dependence on private auto use, and thereby lessen the quantity of combustion products that are emitted daily. To a lesser extent, greater ridership on public transit systems should also reduce the need for more roads, parking lots and parking structures, thereby reducing impacts to habitat that accompany such construction.

In this somewhat busy figure, we see that ridership, as a proportion of the population being served, on the transit systems in Chicago (on top, in black) and Milwaukee, below Chicago (in pink) increased over the period 1996 to 2000. For the other systems surveyed, however, the proportion of the population using the transit systems has remained nearly steady over the same time period.

Ontario "Go Transit" System's Ridership, 1965-1998

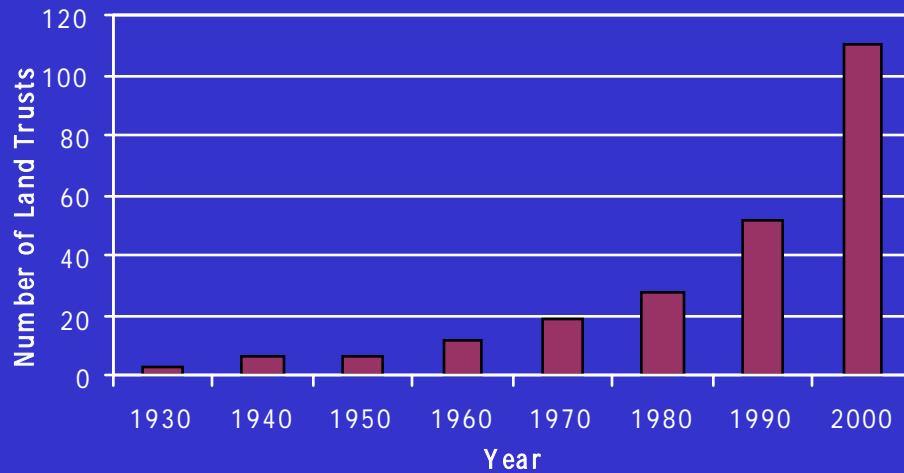


On the "Go Transit" system in Ontario, data are available for both the GO Bus and the GO Rail. Depicted here is ridership beginning in 1965, showing consistently increasing ridership on the rail system in yellow. Ridership on the buses, in light blue, has declined since its peak about 1988, but it has held nearly steady for the past several years.

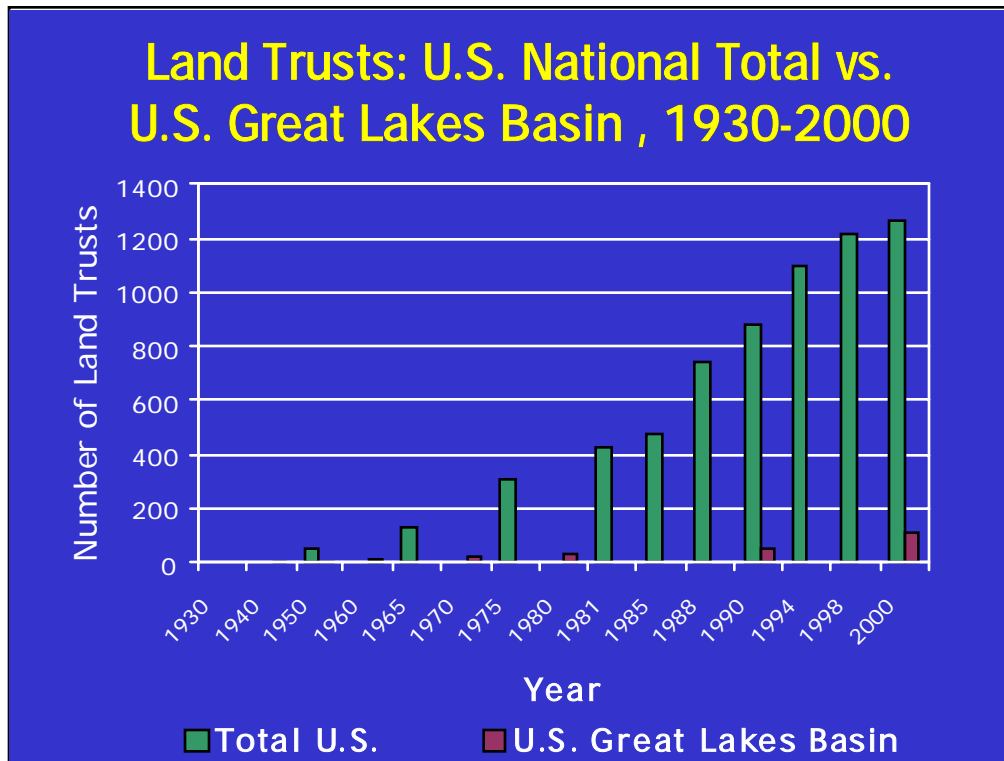


Redevelopment of brownfields is an activity that certainly affects contaminants in the environment, and it also affects the quality of habitat at the sites. Efforts to track brownfields redevelopment, however, are uneven among Great Lakes states and provinces. Not all jurisdictions track brownfields activities, and methods vary where tracking does take place. Information on acres of brownfields remediated from Illinois, Minnesota, New York, Ohio, Pennsylvania and Quebec indicate that a total of 33,389 acres have been remediated in these states and province. Available data from 8 Great Lakes states and Quebec indicate that more than 16,714 sites have participated in cleanup programs.

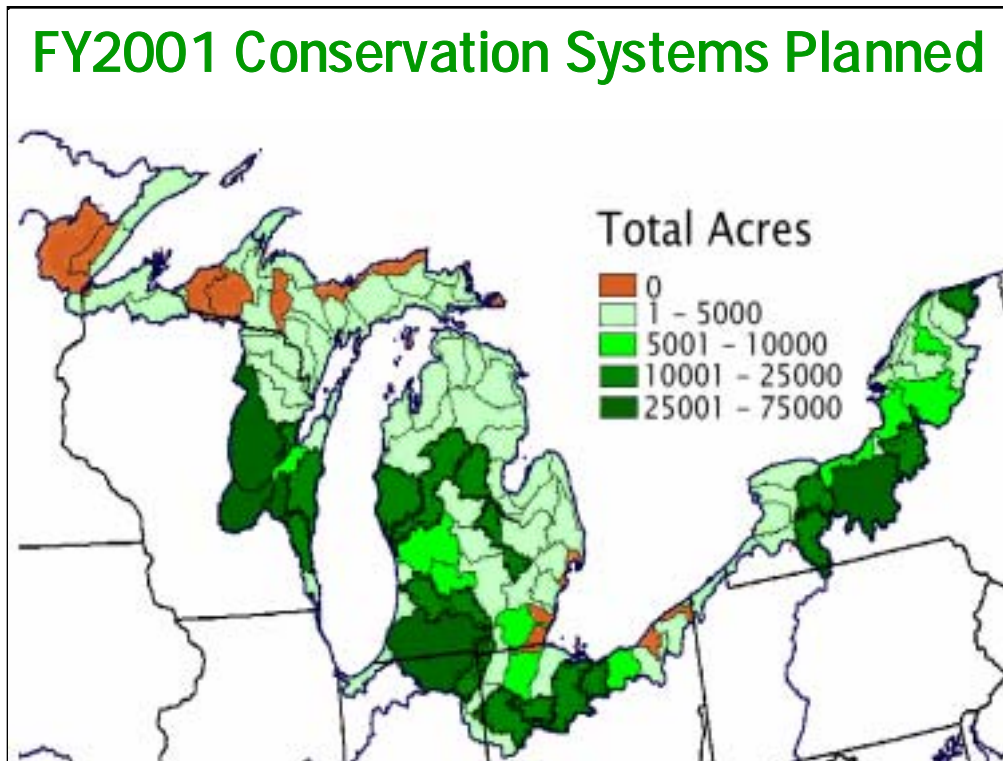
Land Trusts in the United States Great Lakes Basin, 1930-2000



For Citizen/Community Place-Based Stewardship Activities, our example here looks at the number of land trusts that are known to exist in the U.S. part of the Great Lakes basin from 1930 to the present. Land trusts are legal entities that restrict certain land areas from undesirable development activities. The trend is clearly upward, indicating that more lands are being held from development or other exploitation.



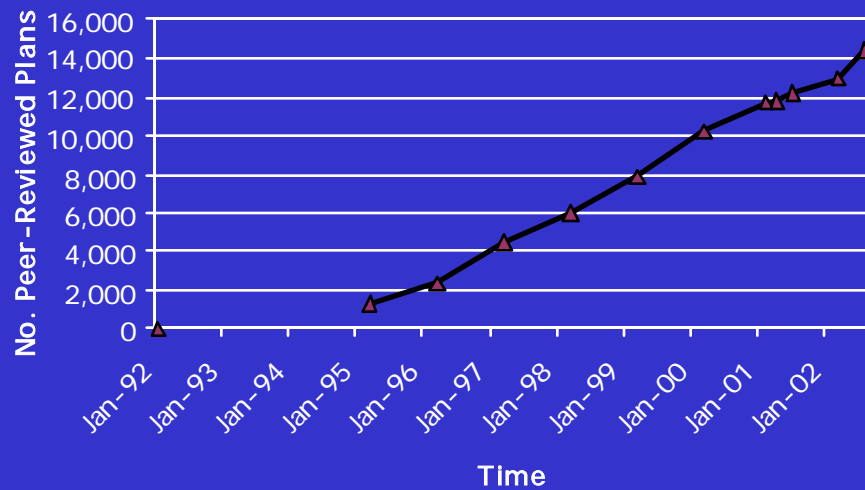
When the land trust data for the Great Lakes, here in red, are compared to the total number known to exist for all of the U.S., we find that the rate of increase in the number of trusts in the Great Lakes has not kept pace with the rest of the U.S.



Sustainable Agricultural Practices in the Great Lakes basin are one of the most visible, effective activities that we undertake to conserve habitat, and reduce contaminants and pathogens, and to some extent, halt the spread of non-native species. Best management practices help to keep soil, pesticides and nutrients on the farms rather than leaving in runoff. They maintain critical ecosystem features such as wetlands and stream water quality. They also prevent potential for bacterial contamination of waters from animal wastes.

Here is a depiction of the number of acres by tributary watershed that are covered under one of the conservation planning programs in the U.S. part of the Great Lakes basin. The darkest green signifies a range of 25,000 to 75,000 acres under a planning program in the watershed. The areas with the most acreage under a conservation plan generally coincide with those that are most heavily agricultural. Participation in these planning programs is voluntary, so we can be encouraged by the level of participation.

Peer-Reviewed Environmental Farm Plans in Ontario



In Ontario, many farmers participate in the voluntary Environmental Farm Plan program. As of January 2002, over 14,000 plans had undergone peer review, which represents about 65% of the farmers who participated in one of the farm planning workshops. The trend since 1997 is clearly toward the creation, and presumably the implementation, of more plans.

Management Challenges: Habitat Alterations

- Encourage place-based stewardship activities

So, what have we seen so far? Several aspects of human habitation around the Great Lakes greatly influence the quantity and quality of habitat of the natural plant and animal residents of the Great Lakes basin. As human populations increase, as urban areas increase, and as suburban areas become compromised, fewer areas remain in which the natural habitat of many of the Great Lakes species continue to exist.

What are we to do? Consider the example of Place-based stewardship activities exemplified by the creation of land trusts. These types of activities become increasingly more important as human populations increase.

Management Challenges: Habitat Alterations

- Control suburban sprawl; minimize human habitation impacts

Controlling urban sprawl. This element in the equation is so important that we could spend a whole presentation discussing it. At SOLEC 1998, Bill Reese spoke about the concept of the Ecological Footprint on the planet earth. In an analysis of the footprint influence of the Great Lakes, our region would require the equivalent of approximately $\frac{1}{2}$ of the land mass of the continental U.S. to support our lifestyle. Our human population is expected to increase in the near future. Where do we put everyone to minimize ecological impacts while maximizing human “quality of life”?

Suburban sprawl is largely a local issue, framed by immediate local concerns that may include tax revenues to support local school districts. On a whole-basin scale, however, control of suburban sprawl may be one of the most critical, and explosive, issues that environmental decision makers need to address.

Management Challenges: Habitat Alterations

- Identify, protect, rehabilitate critical habitats, both aquatic and terrestrial

To identify, protect, and rehabilitate critical habitats, both aquatic and terrestrial, is one of the major management challenges we face today. We have seen how refugia are so important to the survival of native clam species that face extinction from the pressures from zebra and quagga mussels. We have seen how water levels affect the abundance of amphibian and bird species in wetlands. We have seen that bald eagles have begun to re-establish along Lake Ontario, where they have been absent for many years. If we are to preserve the Great Lakes ecosystem in a form anywhere near its natural condition, the preservation and restoration of critical habitats is the key.

Management Challenges: Contaminants and Pathogens

- Emphasize Agricultural Best Management Practices

What are some of the management challenges related to contaminants and pathogens?

Environmental management in the Great Lakes basin has been addressing toxic contaminants for years: contaminants in water, fish, sediments, air, and people. We are also increasingly concerned with pathogens in the water at our swimming beaches. What challenges are still current, and what new ones can we expect?

Loadings of contaminants to the Great Lakes have been greatly reduced from their peak in the 1970s. But we are not out of the woods yet. While controls on industrial emissions of contaminants have been legislated and enforced, agricultural practices to reduce runoff of pesticides and fertilizers are still voluntary. Nevertheless, reductions in non-point source runoff have been very significant. Recent reports in the press, however, have linked an infestation of slugs in corn and soybean crops in Ohio to a string of mild winters. Many farmers may be faced with a return to tillage plowing or to the use of molluscicides to control the situation. Either choice would reverse some of the most encouraging progress toward controlling non-point source pollution.

Management Challenges: Contaminants and Pathogens

- Foster contaminant reducing activities: mass transit; energy efficiency; recycling,

Many of us here at this SOLEC are well versed in the natural sciences, and we are comfortable talking about biology, chemistry, and physical processes. Societal activities are somewhat outside our professional comfort zone. These activities, however, are integral to the protection and restoration of the Great Lakes basin ecosystem. Automobiles are a blessing and a curse. Electrical energy generation comes at an environmental cost. The generation of solid waste implies both a need for land space to put it and lost energy and natural resources to produce it. These issues are not separate from the issues facing the Great Lakes, they are very much a part of the pressures being imposed on the Great Lakes.

Management Challenges: Contaminants and Pathogens

- Encourage brownfield redevelopment

Brownfields, in essence, are unutilized or underutilized properties in the Great Lakes basin that may contain toxic substances in the facilities or perhaps in the surrounding soils. Their rehabilitation to productive and safe work or residential space removes the site from being a potential source of contaminants, and it could reduce some of the pressure of suburban sprawl, so called greenfield destruction.

Management Challenges: Non-Native Species

- Understand relationships between economic well-being and increased threat of introducing non-native species

We have seen this morning that the invasion and spread of non-native species is the most disruptive threat to the Great Lakes ecosystem. Their impacts come at very large economic costs as well as ecological disturbances. What, then, are some of the management challenges that we face?

Intuitively, there would seem to be a link between economic prosperity and the introduction of non-native species. If our nations are prosperous, we will be engaged in trade with many countries around the world, thereby increasing opportunities for unwanted plant and animal visitors to be transported to the Great Lakes basin. We also have more opportunities for recreational travel, and we could be unwitting carriers of newly introduced species. On the other hand, in a robust economy, we as a society may have more resources to invest in environmental protection and restoration efforts.

Management Challenges: Non-Native Species

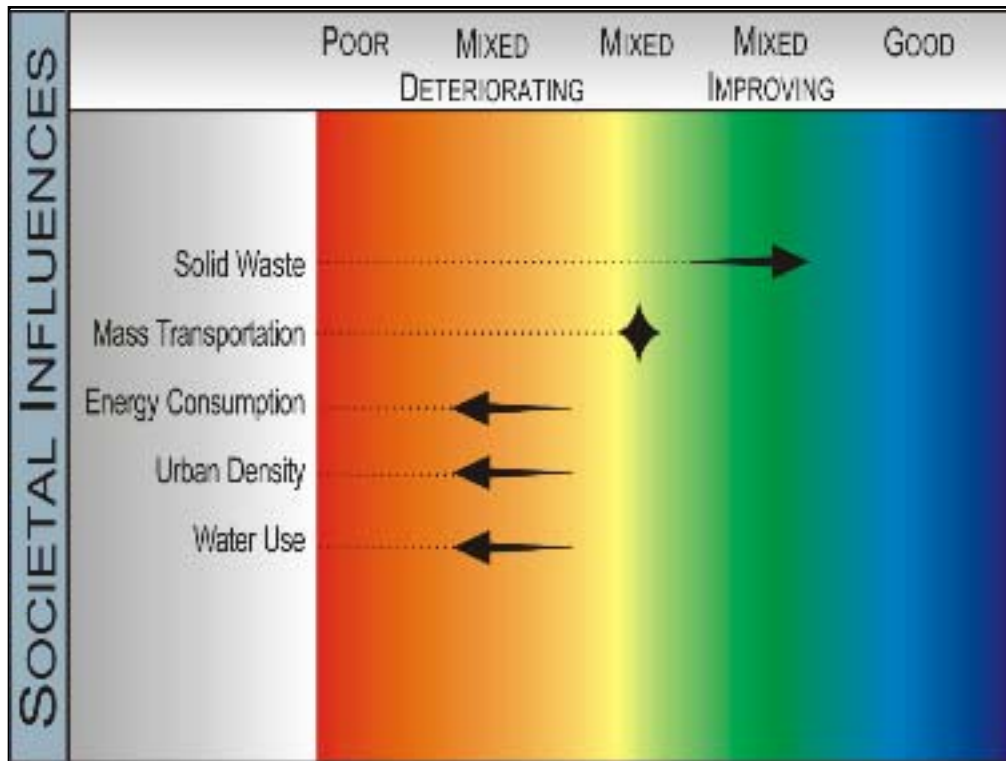
- Prevent non-native species introductions

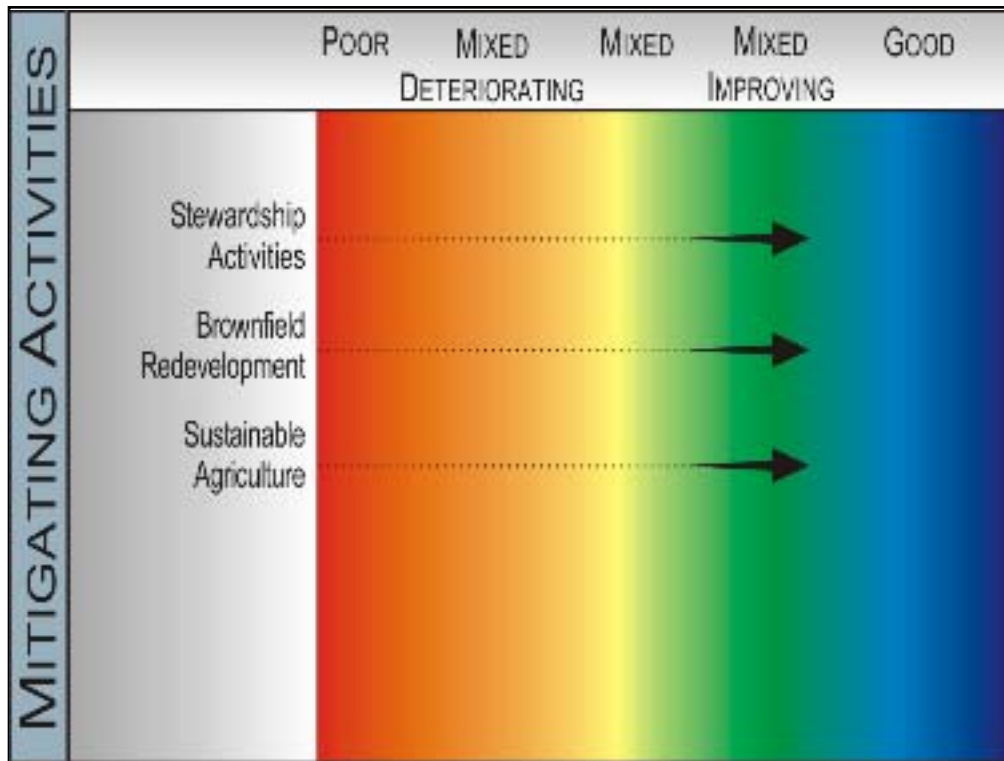
In addition to understanding conditions that may encourage the introduction of non-native species, the problem requires pro-active management solutions. Some approaches may involve physical barriers, such as the electric fish barrier installed on the Chicago Sanitary and Ship Canal. Other approaches may be administrative, such as requiring ballast water exchange or some sort of ballast treatment. These are just some ideas. There are certainly many more that we haven't thought of yet. The point is worth repeating: extinction is forever, so is the introduction of non-native species.

Management Challenges: Non-Native Species

- Continue non-native species control programs such as for sea lamprey

This point should be obvious. Where we have technologies and programs in place, we should be diligent about maintaining them. Where we do not, we might consider implementing additional research efforts to find control solutions. Solutions might be difficult to identify, and they might be expensive to implement, but the cost of not addressing the ecological health of the Great Lakes will be enormous.





The sustainable agriculture assessment is shown as mixed improving. This is because we see increasing trends for the adoption of conservation farming systems and peer reviewed environmental farm plans. Also, in June of 2002 a nutrient management act was passed by the province of Ontario. This will require all farms in Ontario to have a nutrient management plan implemented by 2008.